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E. A. FLORENTINE, M. D.,

Treasurer, Roentgen Society of the United States.

SAGINAW, - - - - - - - - MICHIGAN

The American X-Ray Journal.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. 8. *ST. LOUIS, FEBRUARY, 1901.* *NO. 2.*

THE DEVELOPMENT OF THE X-RAY PLATE.

BY. DR. J. N. SCOTT.

Read before the Roentgen Society of the United States, Grand Central Palace, New York City, December 14, 1900.

So much depends on the development of an x-ray plate that every operator should do this part of the work himself. The x-ray plate is the key to the length of all exposures. An assistant or photographer can tell the operator he has over or under exposed his plate but he cannot express to him the degree he has over or under exposed. This is something that cannot be expressed and can only be learned by carefully watching the development of a large number of plates; after also watching action of the tube during exposure.

As to two persons who will measure the same in the diameter through which a radiograph is taken will not require the same exposure with a given intensity of ray, because the density of the flesh and bone in the two persons vary, we cannot guage the exposure by the thickness in a given region, although we can approximate it.

In order to obtain the best picture with a given power of apparatus the exposure must be nearly correct. Through the thin parts we have much more latitude in exposure than the thick and dense ones: for example, with a given intensity of ray we can expose a wrist from five seconds to five minutes and by varying the development, obtain a fairly good negative. In this case one exposure is sixty times the other, but if we vary a hip exposure five minutes we will generally spoil it entirely.

We can rectify mistakes in exposure, by the development much better through the thin parts than thick ones. It is an impossibility to always obtain good radiographs of thick and dense parts on the first exposure, but after making one exposure and developing the plate, a person experienced in exposing and developing plates can nearly always obtain as good a picture as is possible on the second exposure. The following apparatus is essential in the development of x-ray plates:

A dark room, one which is absolutely dark. A room will often appear dark when you first enter, but after a while, light can be seen at different points, this will not do.

A ruby lamp. This may be either an oil lamp, gas or electric light so constructed that no light can escape except through a plate of orange and one of ruby glass. The light should not be of more than three or four candle power. The oil or gaslight can be regulated by turning it down, and the electric light by a rheostat, when using a ten or sixteen candle power lamp.

If a ruby lamp is bought, only a good one should be purchased. If an incandescent lighting circuit is at hand, a box 10 inches high, 4 inches wide and 8 inches

broad can be made and painted black. A ruby and orange glass can be sealed in one of the 8 x 10 sides, the top of the box can be made so it can be removed. The top should be grooved so it is right tight, and the electric light can be fastened to the under side of the top.

A small adjustable German silver rheostat should be placed in a handy place so the light can be cut down until it is nearly out. Then the rheostat should be made so no more than a certain amount of light which will not fog the plate, can be turned on. It is impossible to judge by the appearance of the light whether or not your dark room is safe to work in, so to test this, take a plate into the dark room, first being sure it is perfectly dark, then wrap one-half the plate in black paper leaving the other half open, and place the plate near the place it would be during development and turn on your ruby light full strength. Expose it for 15 minutes, then turn out ruby light and develop in the dark for 15 minutes, and then fix in Hypo, and if the plate be clear, the light is all right. If the exposed half of the plate shows a deposit and the other half is clear the lamp is not safe and the light must be cut down until this test shows the whole plate to be clear. If the whole plate is foggy, the fault is in the dark room and must be remedied.

A wooden or hard rubber tank grooved and partitioned to hold the various sized plates you use, for washing this should be so arranged that running water can be kept passing through it while in use. If running water is not at hand, 10 to 15 changes of water can be used, but running water is preferable.

A tank the same size and kind as the one used for washing to hold the Hypo solution.

A hard rubber developing tray for each size of plate used, or a single tray for the largest plate used and this will, of course, hold the smaller ones, but it wastes developer when you develop a small plate in a large tray.

One 8 ounce and one drachm graduate. A rack grooved to hold plates while drying, and if you make your own developer, which is far cheaper than buying it already made up, a pair of scales weighing from 1-2 gram to 2 or 4 ounces. Eight or 16-ounce glass stoppered bottles for developers. Nearly all developers should be kept in small tightly corked bottles as they oxidize and spoil if kept in large bottles only partially filled. It is always preferable to use distilled water in making developers and nothing but pure chemicals should be used. I have several times spoiled developers by using impure chemicals.

Chemicals which lose their water chrystalization should be bought in glass bottles or hermetically sealed cartons of the size wanted for immediate use.

It is very important to have the temperature of all developers while using between 60° and 70° Farenheit. In the summer near 60° and in the winter near 70°.

Ordinary photographic plates can be used in x-ray work, but the specially prepared ones have given me the best results. I prefer a double-coated plate, one with a rapid emulsion on top and a slow one underneath, especially if we wish a contrast. By using a rapid single-coated plate we can obtain plenty of detail but little contrast. Nearly all the older manufacturers of plates put out good x-ray plates. A beginner should select some one brand and kind of plate; use it all the time and not change from one kind to another. All of us can do better work when using a plate we are accustomed to working. If good results are not obtained from the first, do not change to another plate because some one else obtains good negatives with some other kind. This same rule applies to developers.

Select a developer of known worth and use it all the time, because if we change from one to another it will take a long time to decide which one to use, and then more time to learn the technique of

using it properly. Always see that your plates are fresh.

A sensitive plate is made of a coating of light sensitive bromide of silver mixed with gelatine and coated on a piece of glass. In order to make a negative the plate must be exposed to the x-ray. Ordinary light will affect a plate but we are only dealing with the x-ray in this article.

In order to protect the plate from other light it is wrapped first in black paper, then in yellow one. A plate holder can be used but the paper is preferable, because by placing the plate on a perfectly flat board, the patient can lay on the plate during exposure, and thus bring the part we wish to take as near the plate as possible. The nearer the plate we place the part to be taken, the sharper the image will be.

When we expose a plate, for example, with a hand on it, we obtain a shadow picture of the hand. This picture is invisible to the eye. The appearance of the plate to the eyes is the same before and after exposure, even with a microscope we can detect no difference.

However, when we immerse the plate in a developing solution and fix it in Hypo, the effects of the x ray will appear as a shadow picture of the hand. The reason we obtain a shadow picture is because this plate is effected by different intensities of the x-ray. The hand being composed of different densitities it will cut off more of the ray in some places than others.

We will suppose the hand we are exposing has a shot buried in one of the bones; that another bone is broken and separated, and another with only an infraction. On the part of the plate over which there was no obstruction, the negative will appear very dark and black; when the flesh is interposed it will appear a shade lighter than the unobstructed portion, and we will have an outline of the hand; then the part obstructed by the bones and flesh will be considerably lighter than the part under the flesh, and there will be an outline of the bones distinguished because they are lighter than the flesh. The spot abstructed by the shot will be still lighter than the bones, consequently it can be distinguished whether in the bone or on either side of it. The fracture can be seen because it will let the light through it and the space between the fractured bones will appear darker than the bones. The infraction will appear as a darker line across the bone because at the point of break although it does not extend through the bone, it will have less bone to go through and less of the ray will be cut off than where the bone is whole. If there should be a softening of the bone it would obstruct less light and the negative would appear darker under it. Then if the bone should be thickened at any point, the plate would appear lighter according to the degree.

In printing the finished picture the light places in the negative will print dark and the dark portions light. With a correct exposure the relative densities of the parts taken can be brought out to a fine degree.

Developers are mostly derivatives of the hydro carbon benzine $C_2 H_6$. Developing solutions consist of the developer proper, an accelerator, a restrainer and a preservative. The developing agents proper are such chemicals as pyro, metol, hydrochomen, etc. These reduce the silver and blacken the shadows. The accelerator is composed of an alkali which increases the power of the developer proper of absorbing oxygen and so accelerates and makes it more active. The alkali most commonly used is carbonate of soda.

Carbonate of potash, caustic soda and aqua ammonia are also used. The preservative is a chemical which will keep the developer from oxidizing when made up in bulk. If the developer is discolored it weakens it and it is liable to stain the film.

Sulph. Soda is the chemical most generally used. It is absolutely necessary to have a neutral Sulph. Soda and one which

has not been decomposed by exposure to air. It should be tested before use, and only transparent crystals should be used, as the majority of it on the market is acid. Just as little sulphate of soda should be used in all developers for x ray plates as will prevent their discoloration, because the less that is used the greater will be the printing capacity in the negative of under exposed portions. This property is especially useful in raidiographs of thick parts.

The restrainer which is used nearly universally is Bromide of Potash. Bromide of Soda and Chloride of Sodium can be used. The effect of the bromide is to dissolve some of the bromide of silver out of the film which maks it harder to reduce, and in this way slows its action. In developing x ray plates with any developer, it is advisable to use bromide as it slows development and allows more of the image to come up before the plate becomes fogged.

A detail often neglected in making developers is the use of distilled water, or one free from iron and organic matter.

These impurities spoil many developers which would otherwise be good, so distilled water should always be used if posble. In mixing a developer from a formula, always mix in the order given and follow any special instructions. If a large quantity of developer is made at one time, put it in a number of small bottles and cork tightly. A glass stoppered bottle is preferable and it is better to use no bottle holding more than 16 oz.

The restrainer in the form of 10 per cent sol bromide of potash should always be at hand during development. I never put the restrainer in my developer when mixing it in bulk, but put in the desired quantity when I pour developer in the tray. Many formulas are used for developing plates, but the ones most used in x-ray work are a combination of metol and hydrochinon, pyrogallol known as pyro and rodinal. Pyro is probably the best all-around developer we have, because it gives us great latitude in adapting it to the different effects wanted, such as detail and contrast, but it has its objections. It oxidizes easily and strains whatever it comes in contact with. It will stain the fingers during development unless care is taken.

The following is a formula in common use for pyro developer:

No. 1.	Dist. Water	32 oz.
	Sulph. Soda Crystals	8 oz.
	Pyro	1 oz.
	Water to make	40 oz.
No. 2.	Water	32 oz.
	Carb. Soda Crystals	8 oz.
	Water to make	40 oz.

To develope take of No. 1, 1 oz , of No. 2, 1 oz. and water 8 oz.

In using this formula on a double coated plate with normal exposure, I use 1 oz. each of No. 1 and 1 and 5 oz. water and then add 5 drops 10 per cent sol bromide of potash. By this method I obtain more contrast with plenty of detail.

If the plate is under exposed do not add more alkali to force the development, as in developing regular negatives, because this will make the bones appear veiled, but use a strong developer made by adding less water and about 7 drops of bromide. If the plate is over exposed use about 2 or 3 drops bromide and 7 or 8 oz. water. In the last year I have used the following formula in all my work.

Metol	90 grains.
Hydrochinon	30 "

Dissolve in 24 oz. water and add sulph. soda crystals, 3 oz ; carbonate of soda crystals, 13 drahms; then add sufficient water to make 32 oz. and put in two 16 oz. glass stoppered bottles. For use on a normally exposed double coated plate take 2 oz. developer, 3 oz. water and 1 drahm 10 per cent sol. bromide of potash.

For an under exposure take 2 oz. developer, 2 oz. water and 1 drahm and 10 drops 10 per cent sol. bromide potash.

For over exposure or very large plates 2 oz developer, 4 oz. water and 50 drops 10

per cent sol. bromide potash. Of course the developer must be modified according to the degree of over or under exposure. In metol we have what is known as a soft developer, one giving plenty of detail and softness and in hydrochinon a hard working developer, or one which gives strong contrasts. These are especially required to bring out the bones in negatives of the thick parts of the body and in locating stones in the kidney.

Of course the quantity and penetration of the ray in making the exposures have much to do with the contrasts in a negative, still the bringing out of the detail and contrasts can be greatly helped in development. The larger the quantity of ray given off by a tube with just sufficient penetration to make the proper exposure in a reasonable time will give the most detail and contrast in a negative. The volume of ray given off by a tube depends on the volume of current passed through it and the penetration by the vacuum of the tube and voltage of current passed through it.

In developing the plate it is taken into the dark room with only the ruby lamp for light.

The developer is put in the hard rubber tray. The paper is removed from the plate and the plate is held in one hand with the film side up. In the ruby light the film side gives a dull reflection of the light, while the clear glass side reflects the light more brightly. The tray is held with the other hand and tipped so all the developer all goes to one edge, and the one edge of the plate is put into the lower edge of the tray and then the rest of the plate dropped on the bottom of the tray. The tray is tilted so the opposite edge becomes the lowest. If this motion does not wet all the film immediately we tilt the tray so that it will. Keep the tray rocking gently all the time of development, so the developer is in motion and passing over all the film. As soon as the film side has turned somewhat dark all over, take the plate out of the tray and examine it by holding it about 10 inches in front of the ruby lamp. If the plate still transmits light and has not commenced to turn dark on the back, return to the developer again for a short time, and as soon as the back of the plate turns a little dark on another examination or ceases to transmit light, even if the back has not commenced to darken, it should be taken out of the developer. It should take from 7 to 10 minutes to develope a normally exposed plate. I always use a fresh developer with each plate. If the plate turns dark immediately after immersing it in the developer, showing over exposure, a little more bromide can be added, or more water. When the additions are made take the plate out of the developer and mix with the developer thoroughly as quickly as possible and replace plate. If under exposed, a little more developer may be added, if it does not darken in 15 minutes.

In negatives of thin parts like the hand, the out line will show fairly plain during development but development must not be stopped as soon as the image begins to fade, as with an ordinary negative but continue till the plate has appearance described before.

If the negative is of a thick part like the hip, sometimes the outline of the bones can hardly be made out, but stop developing when it darkens a little on the back or ceases to transmit the light from the ruby lamp. After the plate is developed, rinse for a few minutes in the box for washing plates, put in hypo bath, and cover up so light can not get to it. I use for my hypo. bath with the addition of sulphuric acid to keep the bath clear and prevent staining of the negatives. Formula:

Water	28 oz.
Hypo	8 oz.

Dissolve and mark No. 1.

Water	4 oz.
Sulpbite Soda	1 oz.
Chrome Alum	½ oz.
Sulphuric Acid	20 drops

Dissolve and add to No. 1.

The Chrome Alum used in the formula is to prevent the film from softening and frilling. I use the Hypo. solution until it is so weak it will not remove the white from the back of the plate in 15 minutes, then I make up a fresh solution. The plate should be left in the Hypo at least 30 minutes, or for 15 minutes after the back of the plate appears dark. The plate is then washed in running water for at least one hour, as in ten or twelve changes; if running water is not at hand, then put it in the drying rack to dry; it should be left in a draught of air, and it will take about twelve hours in summer to six in winter to dry. If the plate is wanted immediately it can be dried in about one-half hour by placing it in front of an electric fan. When a negative has a foggy appearance it is either over exposed, Hypo has been introduced into the developing solution, the developer is too warm or contains too much Carbonate of Soda, too much light in the dark room will also cause it.

Yellow colored negatives are generally caused by using decomposed Sulphite of Soda. Negatives will often be stained yellow or brown by insufficient fixing, also if a plain Hypo. bath is used too many times. Imperfect washing of the negative causes a crystalized appearance and fading of the image.

When a negative is under exposed or under developed, it will have a light appearance inside the outline of the flesh, and when held up to the sun light, the light passes through it readily. When a negative is over exposed or over developed, it is dense and dark all over and little sun light will pass through it. Always wash out the developing tray before and after using it, and let it dry upside down. Never let Hypo. in any form get in the developing tray. After your hands have been in the hypo solution, wash and dry them before touching the tray. If you spill hypo solution on the floor clean it up as when it dries, it will raise with the dust and is liable to get into the developing tray. When I am through developing a plate I drop it into the washing box, wash out my developing tray, and put it in place, upside down. I then take the plate out of the water and put it in the hypo. If I develope several plates one after the other, I wash each, and drop them into the hypo bath without letting my hands touch the hypo, and as a precaution wash my hands after dropping the plate into the hypo.

In hot weather even if you use Chrome Alum in the Hypo. bath, if the developer and Hypo. bath are warm the film will soften and frill. The remedy for this is to use ice in the Hypo. bath, keeping it at about 60° F. and to use a developer at about the same temperture, when ice is added to the Hypo. bath very many times, it dilutes it, and a new bath must be made up.

KANSAS CITY, MO.

The advertising department of the American X-Ray Journal has been heretofore mostly controlled by agencies. As editor I have been unable to forstall in every instance some inimicable advertisements that have marred the otherwise clean pages. With this issue, February 1901 I will personally dictate and be responsible for any such invidious ads.

It is sometimes difficult to draw the line just where right and wrong begin and end. The motives are hard to weigh. But I will weigh them and make firm decision.

The manufacturers of x-ray apparatus and of x-ray tubes, advertising in the American X Ray Journal can be commended for the superior class of goods offered the profession. We have personally seen the apparatus made by these houses and can safely say that they represent all there is in x-ray and electrotherapeutic apparatus. Buy from them.

Subscribe now for the American X-Ray Journal.

A REVIEW OF CASES OF X-RAY "BURNS."

By E. A. FLORENTINE, M. D.

Read before the Roentgen Society of the United States, Grand Central Palace, New York City December 14, 1100.

Immediately following the discovery of the "x-rays" by Professor Whilhelm Conrad Roentgen, the whole scientific world were impressed with the value of this agent. Crude apparatus were thrown together and every available coil, tube and battery, suitable to such an emergency, was brought into commission.

Physicians, electricians and physicists alike experimented in order that they might satisfactorily demonstrate to themselves the reports of the discoverer.

Following these extensive experiments reports were published showing that "burns" had taken place resulting from the use of "x rays."

This word "burn" being used in connection with the discovery of something new, and as the cause of such results was of mysterious origin, much wild talk and writings were entered upon, which has caused prejudice against the use of the x-rays that time alone will overcome.

Had not the vulgar and incorrect word "burn" been used, probably no such bugbear would have followed. The lay assisted by unscientific press writings added much to stimulate the popular prejudice, but when the matter finally reached the courts the climax seemed to have been reached. A verdict against an unforseen error, resulting from practically an unknown cause would naturally tend to retard the progress of any great discovery.

Among the various subsequent names given this so-called "burn" might be mentioned "X-Ray" Dermatitis, White Gangrene, "X-Ray" Blisters, Electric Burns, and many others.

The depilatory effects were classified as X-Ray Baldness, Alopecia Areata Radiosa and Rentgenosa.

All these terms have their advocates but none prove to be generally accepted, and it yet remains for some scientific genius to coin a name suitable for these injuries.

What constitutes an x-ray "burn?" Any pathological process resulting from the exposure of a part of the body to the x-rays may be termed an x ray "burn."

This process may at first be a mere reddening of the skin and advance to the most aggravative form of ulceration. The progression of the pathological process may be either rapid or slow and may terminate at any time.

Another effect recorded and considered separately by some, is the effect produced which causes the hair to fall out. As the results of this depilotory power of rays is not severe and almost if not always responds to treatment, we will put it under the milder cases of "burns."

The question that now confronts us and is probably the most widely discussed and is studded by both physicians and physicists is the *cause* of these peculiar phenomena manifested when a part of the body has been exposed and "burned" by the x-rays.

Whatever theory we may accept it has been demonstrated that two things will add to the danger of producing these injuries, namely, low vacuum and long exposures. (The tube being near the surface of the body usually less than eight inches.)

In all methods of protection suggested, shields are advocated to intervene between the active tube and part to be exposed. This list covers sheet metals, rubber cloth, oiled silk, grounded screens and many others. All of these apparently have to some extent a protective effect regardless of the fact that "burns" have been produced through all and every safety appliance yet brought upon the market. But as I said before, all of these have a somewhat protective effect. Does it not seem plausible that some of the injurious rays are absorbed in passing through these screens, rendering them harmless. The

fact that a low vacuum tube will eminate more dangerous rays than one of a high vacuum would only go to further prove that these protective screens are absorbing or cutting off the dangereus and harmful rays.

In discussing the causes let me quote you a few lines from a certain book on electro-therapeutics: "While it is not yet positively known what causes this injury, it is in all probability due to a bombardment of the tissues by microscopic particles of metal or glass carried off from the metal of the electrodes or the glass of the tube and driven into the tissues by the action of the static charge which they possess." This little extract probably illustrates the theory that is held and defended by many to-day.

The advocates of this theory place implicit faith in the grounded screen and report case after case showing that when the grounded screen is used almost absolute protection is afforded.

When the enthusiasm of this mode of protection was at its height, and many devices were put on market, Prof. Elihu Thomson,, Dr. J. N. Scott and others came forth and showed the fallacy of these theories by reporting actual cases of "burns" resulting from exposures made through a properly grounded screen of aluminum one sixteenth inch in thichness. Prof. Thomson concludes from his series of experiments in the course of which he voluntarily "burned" himself, that "it is well known that x-rays vary in this respect (referring to penetrating power) some being unable to penetrate even moderate thicknesses of tissue, while others penetrate the denser metals with comparative ease. The use of any screen which tends to stop the rays of low penetrating power, and allow those of high penetrating power to pass. is advisable in prolonged use of the ray."

According to this it matters not whether the screen is grounded or not, and as above reports show burns through grounded screens, we will leave the electrostatic disturbance theory to be further discussed by its advocates.

A later and more modern idea of the causes is that it lies in the ray itself and not in some result of its production such as liberating of ozone and above ideas just mentioned; something produced by the rays.

Touching closer to the point we have the actinic rays of the Roentgen rays which have much the same action as the actinic rays of sunlight.

Dr. Pusey summing up this theory says, "And it is no violence to the reason to suppose that the same actinic properties of the x-rays that cause rearrangement of molecules and formation of new salts upon photographic plates can exercise a similar power upon molecular arrangement of tissue calls and influeuce their metabolism." This view is a popular one on what might be known as the actinic theory which in my opinion seems to be gaining friends every day.

Are idiosyncrasies a factor in the causation of these burns? We will consider the idiosyncrasies of persons in regard to drugs, certain modes of treatment etc.

The physician may for years administer certain agents in similar conditions and obtain definite results, when at an unexpected moment some result follows which was entirely unlooked for.

The resistant effect of the skin to the burning rays of the sun varies to the greatest degrees in different individuals; if this be true, why not then the resistant effects of the skin to the burning effects of the x-ray vary in the same extent in individuals, to the degree of no effect at all to a mild or even most dangerous "burn." Furthermore if idiosyncrasies are true of almost all chemical and physical agents why should we draw the line at certain unexpected results that sometimes follow the use of the x-rays?

In discussing the pathological anatomy the degree of the burn must first be con-

sidered. The same conditions exist in the corium and subcutaneous tissues that are true of any inflammatory condition of the skin from a mild demratitis up to an alarming stage of necrosis.

The more characteristic and detailed changes may be seen in what is called the trophic changes, and effect the hair and nails. Dermatologists using this agent tell us that baldness may be produced without dermatitis. The conditions present in these cases are thickening of the epidermis and atrophy of the hair follicles, pigmentation due to an increase of eleiden is charactertstic in some cases.

The symptoms present themselves anywhere from a few hours to several months, but usually ten days will be sufficient to bring out any evil effect. Deep seated pain, dull and aching; redness and swelling followed by vesication which ends here or if severe necrosis sets in and sloughing results. These symptoms have a large range of variation, according to the nature of the case. Cases are recorded in which the symptoms of pain was absent throughout the course. The chronic nature of symptoms are also peculiar to themselves.

A peculiar fact is brought out when we consider the complications and diagnosis. The doubt in the result of bone diseases coincident with the use of the x-rays "osteoplastic periostitis," and "ostitis" have been much confused with x-ray injuries, and it is a much debated question even to this day as to the real condition of cases that have presumably been wrongly diagnosed in the past.

A case that has been reported to me since I reached this meeting, pertaining to this subject reads as follows:

A patient four months ago shot in left thigh. The second day six exposures were taken with tube close to surface. Seven days later the part became reddened, itching and painful, blisters broke out and it finally terminated in an ulcer. The case was brought to a hospital to be operated on, the resident physicians thinking it was diseased bone caused by a bullet that was causing trouble and possibly the bullet itself that caused the continuation of trouble. The doctor in charge of x-ray apparatus diagnosed it as an x-ray burn and refused to take only one short exposure fearing to only further aggrevate the condition.

Treatment for the burn, consisting of removing the mass of necrosed tissue covering the ulcer was at once persued and the bullet was left alone the result so far to-day shows the case progressing favorably.

Dr. M. K. Kassabian furnished me with a history of a case that shows a peculiar or probably common complication.

A soldier shot in the left knee, bullet embeded. The radiographer removed the bullet. The case two months after showed redness and blisters. The patient said it was almost healed, as before it looked like raw meat. Now the previous treatment in this case consisted of carbolic acid and vaseline applied continuously. The doctor thought it was the carbolic acid that kept it aggravated as it healed up readily under treatment of boric acid in lanolin.

Did you ever consider the effect of phenol when applied to a surface of the skin for a long time? Do you not think that cases of mere hyperemias have been aggravated by this agent? The author has in the last two years experienced some very alarming results by the too heroic use of phenol and different dusting powders.

In the treatment of "burns" there is no rule or set of rules to be laid out and followed. The variance of the "burns" would guide every physician to follow his teachings and use his own judgment as to the best course to pursue in such a condition. Care should be taken not to use too stimulatiug or any irritating agent that would be liable to cause a continuation of the original trouble.

What might be called the prophylactic

reatment of x-ray "burns" is the kind of treatment with which every worker in this line should best familiarize himself. This consists of using proper precautions in making all examinations. There is no known means of absolute protection, so it is best to use those that have shown some tendency to help the situation. These might be tabulated as follows:

(a) Short exposures. With our present knowledge and improved apparatus we can accomplish the same results in from 1-20 to 1-30 of the time required by using old apparatus. This alone materially reduces the danger of "burning."

(b) Distance between the active tube and part to be exposed to be over eight inches. If we can do our work twenty-five times as fast by our modern apparatus we can increase the distance between tube and body without material loss. The advantage of this increase of distance will add to the sharpness and detail of negative.

(c) In all events avoid exposing a part frequently unless you are using the rays for some therapeutical result, and then the tube should be regulated to your knowledge of effect to be produced.

(d) In cases where much density is to be overcome and the exposure will necessarily be long, use a protective screen impervious to the dangerous rays. While such a screen does not afford an absolute protection as reports show, it certainly helps to some extent.

(e) The vacuum should be as high as required to get best results with shortest exposure. One of the best ways to accomplish this is to have a different tube for each part of the body, especially adapted for that part, or on the other hand a thorough knowledge of operating the self-regulating tube.

In conclusion I might recapitulate, and make one or two additions not brought out as yet:

1st. That injuries were more frequent immediately following the early use of the x-rays than they are now.

2d. That by using proper precautions as mentioned, and efficient apparatus these dangers may be almost entirely avoided.

3d. That it makes no difference whether a Ruhmkorff coil, a Tesla coil or a static machine is used; their improper use invites danger.

4th. That there is needless cause for alarm among the laity, and we should do all in our power to ameliorate this condition by dealing with our patients in an honest and upright manner, and ever wage an active war against all fake exhibitions, quacks and characters that swindle, humbug and misinform the public against one of the greatest and most useful discoveries of the nineteenth century.

Saginaw, Mich.

INCREASED CAPACITY OF THE STATIC MACHINE.

RETALHULEU, GUATEMALA, Jan. 9, 1901.

Dr. Heber Robarts, Editor of the AMERICAN X RAY JOURNAL, St. Louis:

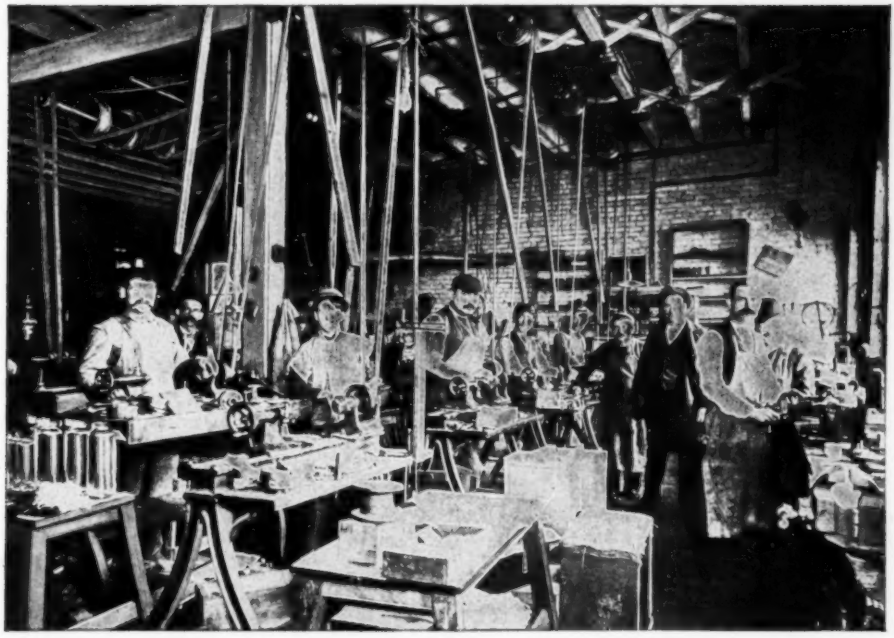
DEAR SIR—Permit me the honor of letting you know that I have increased very much the capacity of the two plates Wimshurst machines by applying to them fan-shaped sectors folded, insulated inside, in order to obtain a large surface for electrical field in a reduced space; just the same like the coils in other kind of machines.

Yours very truly.

JOSE GALLEGOS.

P. S. I inclose a description of my new system of writing. G.

The editor of the AMERICAN X-RAY JOURNAL will gladly answer any inquiry pertaining to the subject matter of the JOURNAL if accompanied with postage. Hundreds of letters come to us from all over the earth by writers who want some information that in no way pertains to us. Postage must accompany these letters for answer.



Sectional view of one of the construction rooms of the Waite & Bartlett Mfg. Co., New York City.

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ROENTGEN SOCIETY.

President's Gold Medal for the Best Practical X-Ray Tube for Both Photographic and Screen Work.

CONDITIONS.

1. The tubes are to be exhausted for testing upon a 10-inch spark coil working at 8-inch alternative spark gap.

2. The tube must be well made and properly capped.

3. The price of the tube will be a factor in the adjudication.

4. The price submitted shall be that at which similar tubes shall be obtainable, retail, through the usual scources.

5. The tube will be tested and marked for:

(*a*) Penetration.
(*b*) Photographic effect.
(*c*) Screen work.

The Jury will be chosen by the President and Council of the Society, and their names will be announced in *The Times* of March 1st,

Tubes intended for competition must be sent in addressed to: The Roentgen Society, 20, Hanover Square, London, W., marked "Tube for Competition," the package containing full name and address of sender, and must reach the Society not later than May 1st, 1901.

Conditions to be obtained on application to F. HARRISON LOW, M. B.,
Honorary Secretary,
12, Sinclair Gardens, West Kensington,
London, W.

GALL STONES UNDER THE X-RAY.

BY J. RUDIS—JICINSKY, A. M., M. D., M. E.

Secretary of the Roentgen Society of the United States, Member of the International Congress for Electrology and Radiology, Paris, France; Member American Medical Association, Western Surgical and Gynecological Association, etc.

The progress made in the diagnosis and the treatment of disease has been most marked in nearly every particular. Not only have the therapeutical resources of the physician been greatly enlarged, but new possibilities in diagnosis placed at the disposal of the medical fraternity, which have, to a large extent, changed the methods not only of diagnosis, but the treatment also. Our fathers in medicine and surgery would be astonished to-day to see the fragments of fractured bones, before they are set and then to examine the case afterwards during repair. The means which are offered to the profession for a correct diagnosis are very ample and the x-ray plays surely the predominant part in the hands of a skillful man. A surgeon's responsibility in all his cases is serious and a matter of much interest to the general public, as grave consequences have and continue to result from errors in diagnosis. Why should we not, therefore, to employ such diagnostic means in our cases, which tell us the truth. While I realize my defects every day, as do all doctors who have practiced for many years, yet I will say, that the new means of diagnosis should be understood by all of us. For example, I will relate just one case. This is a case of gall stones diagnosed by different surgeons, of high repute, very differently. One said it was a case of appendicitis, another simple jaundice and still another pronounced the case as incurable or carcinoma of the liver. Such was the diagnosis made in the beginning, later on they all found their mistake and diagnosed the case as hepatic calculi. The patient herself did not care to be operated on; no wonder, when diagnosis was made in such a manner. But finally she gave her consent, if the gall stones could be found with the help of the x-ray. There is no subject which is of greater interest to surgeons and the general practitioner than the early diagnosis of gall stones. And it seems to me, that it is now, in view of advancement in radiology, within the power of the expert to frequently find the gall stones, if they are of mineral constituents, but not those which contain the cholesterine only. The question will now be pertinently asked: How can we most successsully see them and photograph the gall stones? First, we must know our technique, have steady radiance, know our anatomy and generate enough current from our coil or static to have the tube at its best. To properly operate the x-ray we have to study each given case and must think that to turn the switch or turn the handle is not the whole procedure, which the operator has to know about the radiance. Let us state right here, that this nonchalance was the main cause of misrepresentations and many mistakes, attributed falsely to the x-ray. Our shadow—pictures are not alway correct, especially in the hands of those, who as great surgeons think very little about the study of the technique and knowledge, and try to produce "proper" radiance, like a machine from a machine. It is a very simple matter to make good skiagraphs, if you only know how.

Mrs. A. M., a woman of 34, with a history of acute attack of cholecystitis. There was a marked jaundice present. Temperature 100, when the case was sent to me for x-ray examination. Pulse, 120; weight, 101 pounds; height, 5:1; very thin; diagnosis made: Appendicitis, catarrhal jaundice and carcinoma of the liver in the start. Later on pronounced as a case of hepatic calculi. The diagnosis could not be made positive by diluting the stools voided for the day. Following each attack of the hepatic colic, severe pain diverging

from the hepatic region, and nausea and vomiting were present, suddenly terminating and followed by slight janndice.

Examination with the x-ray: Fluoroscopic examination negative. Six exposures made, and five were negative, because we had forgotten one main thing: to bring the stones, if they should be present, as near as possible to the photographic plate, covered with tungstate of calcium screen. It is very difficult to find just the length of exposure in these cases. If you do not expose long enough the desired result is not obtanied, and if we expose too long the negative will be foggy and the positive no good at all. In our case the exposure was made at 43 degrees for 50 second only. Tube two and a half feet from the body. Plate right under. The skiagraph of the right side of the body shows the outline of the ribs, vertebrae and pelvis, but not so plain in the print, and two gall stones in the gall bladder, one giving a very dark shadow on account of the phosphates, and the other one, having the nucleus of cholesterine with phosphates around, not so plain.

The presence of gall stones being promptly diagnosticated, the patient was advised not to rely on internal medication any more, because this may delay and thereby complicate any effort in surgical way. The consent for the operation was finally given and cholecystotomy done properly, followed by brilliant and most satisfactory result. Two gall stones were found, their shape aud size corresponding exactly with the shadows in our skiagraph, which was as nearly normal size,as possible.

I recognize the fact that we all will have our successful and unsuccessful periods in managing the x-ray for diagnostic purposes, but I will say, with some degree of modesty, of course, that all those who studied the subject thoroughly, those who, for years, made their experiments in medical electrology and radiology, have to succeed in the near future better than those who, after one failure, will or try to push this means of diagnosis aside. I regard the x-ray as the finest product of modern thought, the best means of diagnosis, which should be always tried in every possible case, and every physician and surgeon should be well acquainted with its properties and the proper application of the same. We have seen it in our case, described above, if we would not try and try again, the skiagraph would not have been made and the x-ray would be blamed.

Cedar Rapids, Iowa.

CHANGING POLARITY.

Dr. J. M. G. Beard writes us under date of Feb. 1, 1901, from Fruita, Colo., his method for changing polarity of static machines:

"The method which I shall describe I have never heard of being used by others, and it only applies to machines which have movable Leyden jars. The method is as follows: Set a Leyden jar in contact with either prime conductor and charge it by revolving the plates and separating the sliding-rods, then remove jar, being careful not to discharge it. Give the machine a few turns backward and touch the prime conductors with the hands or a grounded electrode to remove all electricity, then set jar back on machine and in contact with the prime conductor *opposite* the one from which it was taken, start machine into action and the polarity will be changed."

Professor Virgilio Machado, of Lisbon, Portugal, has edited the Portugese Section of the *Exposition Universelle* of 1900, pertaining to radiology and electricity in medicine. The volume is a credit to the eminent author. It is printed on good paper and is freely supplied with good illustrations. It is printed in French.

CASE OF TISSUE INJURY BY X-RAY, AND RESULT OF PROSECUTION IN COURT.

By L. A. Perce, M. D. M. E.

The uncertain conclusions held by numerous writers upon the subject, as well as the great interest to me of this my first experience in injuries of x-ray, prompts me to give the full history of this case.

I will state, I had been using the apparatus almost continuously for eight months before this so called burn occurred, without the least sign of skin irritation, as well as since the injury, with still no further influence. I use a Ruhmkorff coil made by the Edison Manufacturing Company, capable of an eleven inch spark. I operate it by the one hundred ten V. current from street circuit. I control my voltage by the use of ten, thirty-two candle power incandescent lamps, placed in series, reinforced by a sliding rheostat. This gives me ample power, and permits of a wide variation, as I may see fit to cut out or use any number of lamps.

On January 20th., 1900, one, A. L. Bancroft, of Los Angeles, came to me with a history of injured right shoulder of eighteen months standing, and wanted a radiograph of the same, stating several physicians said his shoulder was dislocated, and others, said it was not; he stating that when doctors disagreed, who could settle the point except the x-ray. I placed him upon the operating table, with coat, vest and suspenders removed, with a plate under right shoulder, a good Biddle tube ten inches from his shoulder, in a five minutes exposure. When my plate was developed, I found it badly fogged. On January 24th., he returned; an exposure of ten minutes given at fourteen inches distance, and no picture obtained. On January 27th., he again returned and I made two exposures, at sixteen inches; one of fifteen minutes and one of twenty-three. This time a fair picture was the result, showing the true condition of shoulder joint.

My subject was a very large, thick chested man, weighing two hundred and twenty pounds. He stated that in about two weeks a bright red spot, some three or four inches in diameter, appeared upon his right breast, above and to the right of the nipple, which later produced a sore andwas hard to heal. He, also, claimed sharp pains ran down his right leg to knee; then below this point to heel, and finally to bottom of foot. Also, his beard on the right side of his face, fell out, but finally returned.

Soon after this, he wrote me, charging me with responsibility in the matter sufficient to warrant him in demanding of me compensation to the amount of three-hundred and fifty dollars. This I at once refused, as I felt I was in no wise to blame, and not wishing to stultify myself and establish a procedure in such a case, I refused to comply with his request for any remuneration whatever. Consequently, his attorney, in July, 1900, began suit against me in the Superior Court of Los Angeles County, for damages to the amount of five thousand dollars. The case came to trial January 14th, and 15th, 1901, and after less than ten minutes deliberation by the jury, they found a verdict in my favor.

Many interesting points were presented during the trial of the case, showing how necessary it would be that one operating with the x-ray, should fully give their subjects to understand accidents had occurred from its use, and others may happen. I took the precaution to advise him that cases had been recorded where it had produced what was called a burn, but I had never seen one. This he corroborated himself upon the witness stand, and Judge Shaw held this to be sufficient warning, even if warning should be required. The plaintiff introduced two witnessess as experts, who directly testified no blame could attach to

one operating any kind of a machine for x-ray purposes when ordinary care was employed, such as even far less than I had employed in this case. While no protection such as aluminium plates or any intervening metalic substance was used, I did carefully cover his face and shoulder with clean sterlized towls. Dr. Yoakum, one of their own expert witnesses, stated he had number of times burned subjects and some in less time, and others in greater or longer exposures. Dr. N. N. Morrison, chief surgeon of the Santa Fee R. R., another of their witnesses, testified he, himself, had submitted to three exposures for diagnostic purposes, of thirty minutes each upon succeeding days, and received a very severe burn of the whole abdomen, and right hip, this to by a man in whom he had, and did still place, the utmost confidence in his skill and knowledge, and in no wise did he consider him, nor his apparatus, to blame. He further expressed himself as a firm believer inthe accumulative theory of the ray as well as possibly the peculiar condition of the salts of the body in some subjects, making them particularly suseptible to the chemical action or effectss of the ray. His theory was to the effect that nature likes to work in the dark and the smaller blood vessels in particular being disturbed for some minutes by the bright penetrating rays, become disoganized to a degree so that an unhealthy condition was established, which resulted in death of the parts affected. Only one witness saw fit to do all in his power to fasten the blame upon the operator, and he knew nothing of the principle or character of the x-ray, but lays claim to being a skin specialist. His testimony was accepted by the jury as a huge joke, and he left the stand weaker than upon taking it.

In my defense, we saw fit to introduce only two witnesses, as our case was made clear by the testimony of these they expected to prove my negligence, carelessness and unskillful application, with which they charged me in their complaint.

In conclusion, permit me to say, that if I have been able in defending myself in this unsought, and uncalled for prosecution, to half establish the fact, that as medical men, we can use, and are willing to use all modern and approved appliances for the purpose of diagnosis, therepeutical effect, among which the x-ray stands prominent, and feel some full degree of security granted and secured by law, I shall feel no regrets from worry of mind, nor financial consideration. There never exlsted in my mind at any stage of the case the least uncertainty as to the results of the trial of the case.

LONG BEACH, CAL.

The radiograph of gall stone mentioned in Dr. Rudis-Jicinsky's article of this issue is the nearest approach to a perfect picture we have thus far had the pleasure of seeing. It is through this persistent effort on the part of the operator that he has accomplished so much in radiography. Few persons would try six times to produce something that was of doubtful existence and also, if present, had in the great majority of cases the same density as liver structure. Occasionally, constituents of gall stones differ some containing phosphates, and the rays are absorbed sufficient to have the impression upon the plate. In this case the gall stone is very clear, but the surrounding tissues and bony structure is very indistinct.

In the American Journal of Surgery and Gynecology, St. Louis, edited by the master surgeon of the Mississippi Valley, Dr. Emory Lanphear, we are pleased to read a synopsis of the method of removing semi-malignant growths with the electric current and the wide difference in the use of the current for the cure of benign and malignant growths.

STATIC IN MONTREAL.

MONTREAL, FEB. 10, 1901.

MY DEAR DOCTOR ROBARTS:

I regret exceedingly that I was unable to be present at the first annual meeting of the Roentgen Society of America.

Your excellent journal, however, has given a very full account of the proceedings, and I am glad so eminent a chemist and scientist as my fellow citizen, Dr. Girdwood, has been identified with the work. Subject to correction, I must, however, take exception to a statement attributed to him. Speaking of x-ray tissue destruction (burns so-called) he is reported as saying that in Montreal the worst burns have been from the static machine, and that he never had a burn. I am not aware of any one in Montreal using the static machine habitually except myself. I have a 30-inch 8-plate machine, and have exposed experimentally for an hour at a distance of 8 (eight) inches from the skin, and had a slight erythema following. My tube is a Fessenden specially made for me, and is known as a 20-in. vacuum. I use, and have used, my machine daily for three years, without anything approaching a dermatitis, on all cases, from an infant of twelve months up.

On the other hand, I am informed of two severe burns from the coil in use at a hospital in this city.

Another thing I don't understand is how Dr. Girdwood uses a high vacuum tube with only a seven-inch spark. One of the tubes I use, which I call my medium tube, was discarded at the same hospital as being too high a vacuum for the pressure of their coil (an 8-inch coil).

I should be much interested to hear details of the burns caused by the static machine mentioned.

Lest my remarks might be understood to advocate solely the static machine, I would add that in my experience, the static machine is best for skiascopy, while it cannot approach the coil for certain skiographic effects, and a complete installment, I believe, would embrace both.

Faithfully,

ROBERT WILSON, M. D.

THE ROENTGEN SOCIETY OF LONDON.

At a recent meeting Mr. Isenthal read a paper on "The Progress of Radiography on the Continent." Out of a hundred public institutions on the Continent using the Roentgen rays, only three were satisfied with a 10-in. spark, seven used a 12-in., thirteen a 14-in., forty five a 16-in., thirty a 20-in. and two a 24 in. spark. And on the Continent more attention was paid to the diagnosis of internal disease and injury than was the case in this country. Mr. Isenthal exhibited and described an ingenious form of reclining couch, never before shown in England. On this the patient is laid for examination. Two tubes below give a 12-in. spark, and the shadow of the organ to be examiued is projected on a fluorescent screen. By means of a metal pen moving on an arm, it was also possible to make a tracing of the internal organ on a sheet of paper or on the body of the patient. The table was designed for use in cases of heart disease, but could be adapted for the examination of other organs, or to diagnosing diseases of and injuries of the bones.

The Roentgen Society of the United States met here Dec. 13th and 14th in the library of the Grand Central Palace Hotel and had a most successful and interesting meeting.

The x-ray men had come and gone before I knew of it and I am very sorry for our friend Dr. Robarts the x-ray editor of St. Louis was President. I regret that he did not inform me of his meeting. — Medical Mirror, New York City.

We will not forget you at our next meeting, doctor. Join the society that is doing so much for diagnostic medicine and is in line with your advanced thinking.

ACCURACY OF THE X-RAY.

Horsky's discussion of the fallacies of the x-ray hinges largely upon skiagraphs and alleges that they are not entitled to the credence given to ordinary photographs. His reply to inquiry sent to surgeons concerning the status of the x-ray in legal medicine was negative or neutral. If the eminent writer and the surgeons he addressed had read the AMERICAN X RAY JOURNAL, and especially volume 5, No. 6, and that article entitled Photographs and Radiographs, he and they would have been long since in the light. It is wholly irrelevant on the part of doctors to discuss this matter, because it is one of the fixtures in radiography that fallacies only follow the untutored or is the result of carelessness. Nothing is more accurate in diagnostic medicine than the x-ray. If you don't know how, read the AMERICAN X-RAY JOURNAL and practice its teachings.

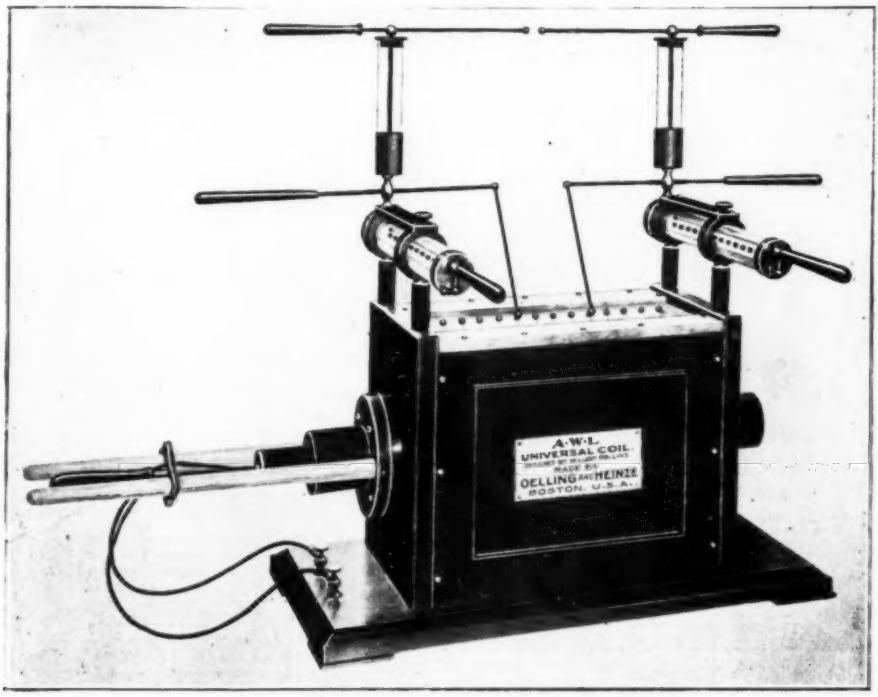
Those who are studying how to round off sentences about the inaccuracies of the x-rays should read the AMERICAN X-RAY JOURNAL and learn how to use the x-rays with accuracy.

Knowledge is a monthly publication, which deserves the confidence of all persons interested in the sciences. The reading matter is clean and high grade, dealing with subjects that interest the thinking mind. It is published in London, England, and founded by Richard A. Proctor.

The *Journal of Physical Therapeutics* has changed from a monthly to a quarterly. It is one of the most interesting of English publications. The January, 1901, number is most instructive. The article by Prof. Finsen on Light Rays appeals to every one devoted to the healing art.

In the March number, next issue, of the AMERICAN X-RAY JOURNAL the four committees will be named that were provided for at the annual meeting of the Roentgen Society of America. Also the next place of meeting of the society will be named. These committees are to fill a place wholly unique—new in name and new in service to be given to diagnostic medicine. They will rewrite the literature of all that pertains to the x-ray. The functions of this office has been divided into four parts.

Report of a case has recently come from Chattanooga, Tenn., in which is described the location of a 38-caliber bullet, at the posterior base of the cerebrum about 1½ inches from the bony arch. Drs. G. A. Baxter and H. Berlin performed the surgical operation. Prof. W. O. Horner did the x-ray work. Prof. Horner owns the fluorometer and does *not* locate bullets "with inaccuracy."



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ELEMENTS OF CORRECT TECHNIQUE . . . . .

By S. H. MONELL, M. D

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